ABSTRACT OF THE DISCLOSURE

Described herein is a method for constructing a multipurpose error-control code for multilevel memory cells operating with a variable number of storage levels, in particular for memory cells the storage levels of which can assume the values of the set $\{b^{a_1}, b^{a_1 a_2}, \ldots, b^{a_1 a_2 \cdots a_h}\}$, with b, a_1, ..., a_h positive integers; the error-control code encoding information words, formed by k q-ary symbols, *i.e.*, belonging to an alphabet containing q different symbols, with $q \in \{b^{a_1}, b^{a_1 a_2}, \ldots, b^{a_1 a_2 \cdots a_h}\}$, in corresponding code words formed by n q-ary symbols, with $q = b^{a_1 a_2 \cdots a_h}$, and having an error-correction capacity t, each code word being generated through an operation of multiplication between the corresponding information word and a generating matrix. The construction method comprises the steps of: acquiring the values of k, t, b^{a_1}, $b^{a_1 a_2}$, ..., $b^{a_1 a_2 \cdots a_h}$, which constitute the design specifications of said error-control code; calculating, as a function of $q = b^{a_1}$, k and t, the minimum value of n such that the Hamming limit is satisfied; calculating the maximum values $\hat{n}$ and $\hat{k}$ respectively of n and k that satisfy the Hamming limit for $q = b^{a_1}$, t and $(\hat{n} - \hat{k}) = (n-k)$; determining, as a function of t, the generating matrix of the abbreviated error-control code $(n-k)$ on the finite-element field $GF(b^{a_1})$; constructing binary polynomial representations of the finite-element fields $GF(b^{a_1})$, $GF(b^{a_1 a_2})$, ..., $GF(b^{a_1 a_2 \cdots a_h})$; identifying, using the aforesaid exponential representations, the elements of the finite-element field $GF(b^{a_1 a_2 \cdots a_h})$, which are isomorphic to the elements of the finite-element fields $GF(b^{a_1})$, $GF(b^{a_1 a_2})$, ..., $GF(b^{a_1 a_2 \cdots a_{h-1}})$; establishing biunique correspondences between the elements of the finite-element fields $GF(b^{a_1})$, $GF(b^{a_1 a_2})$, ..., $GF(b^{a_1 a_2 \cdots a_{h-1}})$ and the elements of the finite-element field $GF(b^{a_1 a_2 \cdots a_h})$ that are isomorphic to them; and replacing each of the elements of said generating matrix with the corresponding isomorphic element of the finite-element field $GF(b^{a_1 a_2 \cdots a_h})$, thus obtaining a multipurpose generating matrix defining, together with the aforesaid biunique correspondences, a multipurpose error-control code that can be used with memory cells the storage levels of which can assume the values of the set $\{b^{a_1}, b^{a_1 a_2}, \ldots, b^{a_1 a_2 \cdots a_h}\}$.

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